

GMSEC

GSFC Mission Services Evolution Center



## At A Glance

NASA's GSFC GMSEC architecture provides a scalable, extensible ground and flight system approach for future missions.

## Features

- Standardized messages formats
- Plug-and-play components
- Information software bus
- Platform transparency

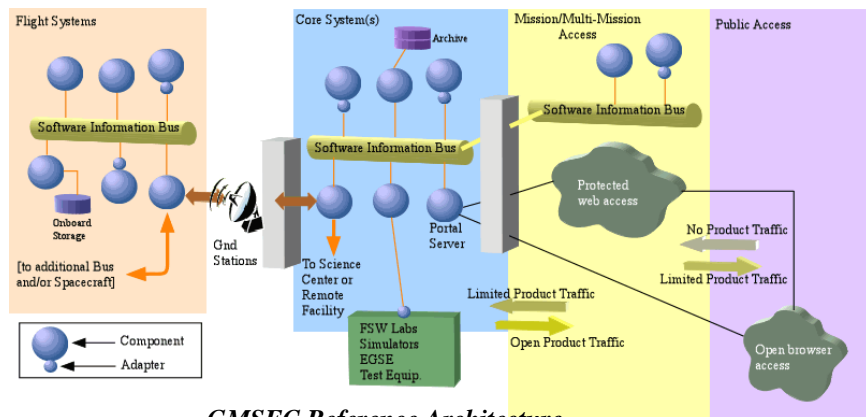
## Benefits

- Simplifies integration
- Facilitates technology infusion
- Supports evolving operations concepts
- Enables future missions

## NASA's GMSEC Reference Architecture

### Summary

The GMSEC architecture provides a scalable, extensible ground and flight system approach for future missions. The architecture enables quick and easy integration of functional components that are selected to meet the unique needs of a particular mission. The architecture enables the addition, deletion, and exchange of components to meet the changing requirements of missions as they progress through their lifecycles and provides a rapid, flexible, and cost-effective means to meet a wide variety of evolving mission concepts and challenges.



GMSEC Reference Architecture

### Objective

*To create a vision and architecture on which to base continued ground system and flight software development efforts at GSFC over the next 10 years.* GMSEC will support the development of mission support tools that can easily be integrated within a GMSEC-based system. GMSEC enables this system-level development approach by maintaining the reference architecture, defining standard messages, and supplying interface software. GMSEC project documents discuss guidelines and policies for assembling systems with the GMSEC architecture. The GSFC Information Systems Division and Mission Engineering and Systems Analysis Division provide software development of functional components. Missions select those components that best fit their operational needs. By selecting the GMSEC architecture approach and using the GMSEC certified components where appropriate, the development organization can prepare a system at a lower cost that is compatible with other GSFC GMSEC systems. In addition, as technology advances or operational requirements change, new components can be added or existing components can be upgraded and components can be swapped in and out of the system with low risk and minimal integration effort.

### Team Roles

- GMSEC "owns" the reference architecture and the standards
- GSFC development organizations are responsible for their domain areas
- Current and future missions are GMSEC's customers

NASA GSFC Mission Services Evolution Center, Code 581  
 Greenbelt, Maryland 20771  
<http://gmsec.gsfc.nasa.gov>  
 email: gmsec@nasa.gov

## GMSEC Architecture Characteristics

The GMSEC Reference Architecture and its flight/ground system instantiation have characteristics that make it an attractive choice for GSFC missions:

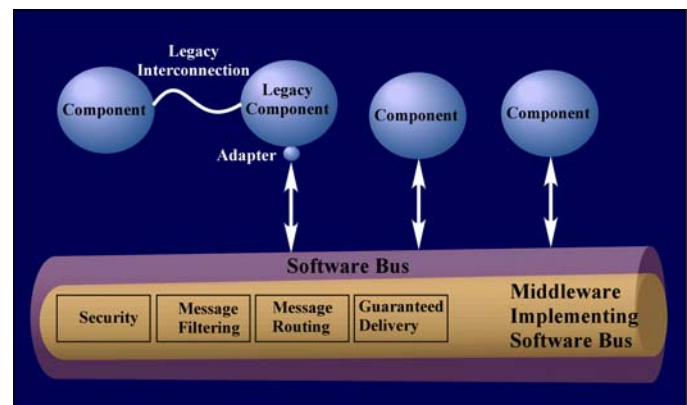
- Wide set of mission component choices
- Standard message formats for component information exchange
- Improved component reuse
- Quick & easy functional component integration
- Middleware support for GOTS/COTS software
- Scalable, extensible ground & flight system architecture
- Exchangeable & dynamic component activation on operating ground or flight system
- Increased system wide automation capabilities
- Additional capabilities can be added to the system without impacting existing system/design
- Security, remote & shared access
- Shared operations with another site (University, commercial provider)
- Mission critical system risk improvement
- Collaboration across missions is simplified with interface commonality
- Anticipation of movement of some ground functions on-board

## Why Standardize Key Interfaces?

Standardization of components allows for a high level of reuse as multiple missions utilize the same tools. Over time, however, these tools may become stale, new requirements may go unmet, improved options may become available, and new missions may have different preferences. Standardization of interfaces creates an environment where new tools can be added over time, obsolete components can be replaced, and new missions are not bound by component selection decisions made many years earlier. Technology advancement can be made incrementally and the impacts of product vendor failures or new requirement are minimized.

## GMSEC Architecture Features

The Reference Architecture features include plug-and-play components, standard messages, and the software information bus. Components can be core functional applications such as Telemetry & Command, Planning & Scheduling, Assessment & Archive, Guidance Navigation & Control, and Simulation & Modeling or new stand-alone functions. In many cases, there will be multiple components covering the same functional area so that a mission may select the component best matched to the mission needs. The components publish/subscribe to the information bus using standard messages. The GMSEC Applications Programming Interface (API) shields the components from dependencies on communication protocols, operating systems, and hardware platforms thus facilitating platform transparency for the components. The API supports several communications middleware products, providing additional flexibility. Legacy components interface to the Software Information Bus using adapters that translate legacy component messages and/or protocols to those that are GMSEC-compliant. Additionally, legacy components may, in combination with GMSEC, continue to use legacy interconnections.



*Components Interface to the GMSEC Software Bus*

## GMSEC Development Lab

The GMSEC Reference Architecture is validated in the GMSEC Development Lab, located in Building 23 on the GSFC campus. A local area network enables connectivity of other campus labs facilitating collaborative development and testing. The GMSEC lab provides multiple operating systems, languages, and communications protocols. Activities include development, benchmarking, demonstrations, evaluations, system integration, functional testing, execution of and what-if scenarios. New components can easily be brought into the GMSEC Development Lab, augmented with adapters, and be tested with other components. One of the key uses of the GMSEC Development Lab is for interested missions to “try out” GMSEC compliant GOTS and COTS for evaluating potential flight and ground data system components.

